SBC

User Manual

SBC-984

Single Board Computer
with NXP i.MX6 Processor

SECO

www.seco.com

REVISION HISTORY

Revision	Date	Note	Ref
1.0	20th June 2013	First Official Release.	SB
2.0	10th March 2014	Updated to rev. B of the PCB	SB
3.0	16th December 2014	New release, suited to rev. C of the PCB	SB
3.1	29th October 2015	RTS# and CTS# signals removed from connector J5. Paragraph 3.3.7 updated consequently	SB
4.0	26th January 2016	Product name Change	SB

! All information contained in this manual is related to SBC-984 board with PCB REVC or higher. For boards with PCB REVB or less, please refer to information contained in SECOµSBC-i.MX6_Manual_Rel_2.0.

Every effort has been made to ensure the accuracy of this manual. However, SECO S.r.l. accepts no responsibility for any inaccuracies, errors or omissions herein. SECO S.r.l. reserves the right to change precise specifications without prior notice to supply the best product possible.

For further information on this module or other SECO products, but also to get the required assistance for any and possible issues, please contact us using the dedicated web form available at http://www.seco.com (registration required).

Our team is ready to assist.

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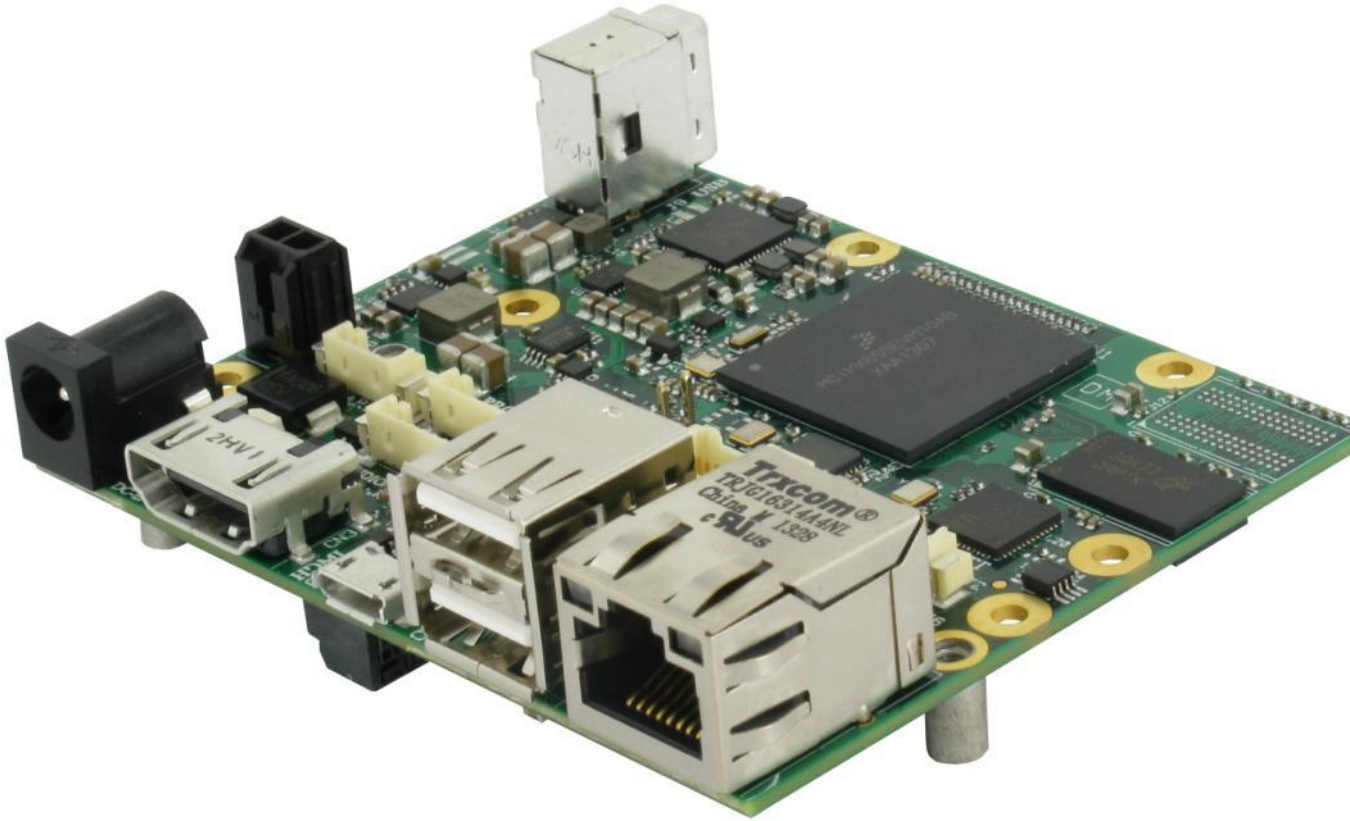
Chapter 1.
INTRODUCTION

- Warranty
- Information and assistance
- RMA number request
- Safety
- Electrostatic discharges
- RoHS compliance
- Terminology and definitions
- Reference specifications



1.1 Warranty

This product is subject to the Italian Law Decree 24/2002, acting European Directive 1999/44/CE on matters of sale and warranties to consumers.

The warranty on this product lasts for 1 year.

Under the warranty period, the Supplier guarantees the buyer assistance and service for repairing, replacing or credit of the item, at the Supplier's own discretion.

Shipping costs that apply to non-conforming items or items that need replacement are to be paid by the customer.

Items cannot be returned unless previously authorized by the supplier.

The authorization is released after completing the specific form available on the web-site http://www.seco.com/en/prerma (RMA Online). The RMA authorization number must be put both on the packaging and on the documents shipped with the items, which must include all the accessories in their original packaging, with no signs of damage to, or tampering with, any returned item.

The error analysis form identifying the fault type must be completed by the customer and has must accompany the returned item.

If any of the above mentioned requirements for RMA is not satisfied, the item will be shipped back and the customer will have to pay any and all shipping costs.

Following a technical analysis, the supplier will verify if all the requirements, for which a warranty service applies, are met. If the warranty cannot be applied, the Supplier will calculate the minimum cost of this initial analysis on the item and the repair costs. Costs for replaced components will be calculated separately.

Warning!
All changes or modifications to the equipment not explicitly approved by SECO S.r.l. could impair the equipment's functionality and could void the warranty

1.2 Information and assistance

What do I have to do if the product is faulty?

SECO S.r.l. offers the following services:

- SECO website: visit http://www.seco.com to receive the latest information on the product. In most of the cases it is possible to find useful information to solve the problem.
- SECO Sales Representative: the Sales Rep can help to determine the exact cause of the problem and search for the best solution.
- SECO Help-Desk: contact SECO Technical Assistance. A technician is at disposal to understand the exact origin of the problem and suggest the correct solution.

  E-mail: technical.service@seco.com

  Fax (+39) 0575 340434
- Repair center: it is possible to send the faulty product to the SECO Repair Centre. In this case, follow this procedure:
  - Returned items must be accompanied by a RMA Number. Items sent without the RMA number will be not accepted.
  - Returned items must be shipped in an appropriate package. SECO is not responsible for damages caused by accidental drop, improper usage, or customer neglect.

Note: Please have the following information before asking for technical assistance:

- Name and serial number of the product;
- Description of Customer's peripheral connections;
- Description of Customer's software (operative system, version, application software, etc.);
- A complete description of the problem;
- The exact words of every kind of error message encountered.

1.3 RMA number request

To request a RMA number, please visit SECO's web-site. On the home page, please select "RMA Online" and follow the procedure described.

A RMA Number will be sent within 1 working day (only for on-line RMA requests).

1.4 Safety

The SBC-984 board uses only extremely-low voltages.

While handling the board, please use extreme caution to avoid any kind of risk or damages to electronic components.

> **!**
>
> Always switch the power off, and unplug the power supply unit, before handling the board and/or connecting cables or other boards.
>
> Avoid using metallic components - like paper clips, screws and similar - near the board when connected to a power supply, to avoid short circuits due to unwanted contacts with other board components.
>
> If the board has become wet, never connect it to any external power supply unit or battery.

1.5 Electrostatic discharges

The SBC-984 board, like any other electronic product, is an electrostatic sensitive device: high voltages caused by static electricity could damage some or all the devices and/or components on-board.

> **!**
>
> Whenever handling a SBC-984 board, ground yourself through an anti-static wrist strap. Placement of the board on an anti-static surface is also highly recommended.

1.6 RoHS compliance

The SBC-984 board is designed using RoHS compliant components and is manufactured on a lead-free production line. It is therefore fully RoHS compliant.

1.7 Terminology and definitions

AC'97	Audio Codec'97, a standard for audio hardware codecs developed by Intel® in 1997
ACPI	Advanced Configuration and Power Interface, an open industrial standard for board's devices configuration and power management
AHCI	Advanced Host Controller Interface, a standard which defines the operations modes of SATA interface
API	Application Program Interface, a set of commands and functions that can be used by programmers for writing software for specific Operating Systems
CAN Bus	Controller Area network, a protocol designed for in-vehicle communication
CEC	Consumer Electronics Control, an HDMI feature which allows controlling more devices connected together by using only one remote control
CSI2	MIPI Camera Serial Interface, 2nd generation standard regulating communication between a peripheral device (camera) and a host processor
DDC	Display Data Channel, a kind of I2C interface for digital communication between displays and graphics processing units (GPU)
DDR	Double Data Rate, a typology of memory devices which transfer data both on the rising and on the falling edge of the clock
DDR3	DDR, 3rd generation
DVI	Digital Visual interface, a type of digital video display interface
FFC/FPC	Flexible Flat Cable / Flat Panel Cable
GBE	Gigabit Ethernet
Gbps	Gigabits per second
GND	Ground
GPI/O	General purpose Input/Output
HDMI	High Definition Multimedia Interface, a digital audio and video interface
I2C Bus	Inter-Integrated Circuit Bus, a simple serial bus consisting only of data and clock line, with multi-master capability
LVDS	Low Voltage Differential Signaling, a standard for transferring data at very high speed using inexpensive twisted pairs copper cables, usually used for video applications
MAC	Medium Access Controller, the hardware implementing the Data Link Layer of ISO/OSI-7 model for communication systems
Mbps	Megabits per second
MIPI	Mobile Industry Processor Interface Alliance
MMC/eMMC	MultiMedia Card / embedded MMC, a type of memory card, having the same interface as the SD card. The eMMC is the embedded version of the MMC, i.e. they are devices that incorporate the memory controller and the flash memories on a single BGA chip
N.A.	Not Applicable
N.C.	Not Connected

OpenCL	Open Computing Language, a software library based on C99 programming language, conceived explicitly to realise parallel computing using Graphics Processing Units (GPU)
OpenGL	Open Graphics Library, an Open Source API dedicated to 2D and 3D graphics
OpenVG	Open Vector Graphics, an Open Source API dedicated to hardware accelerated 2D vector graphics
OS	Operating System
OTG	On-the-Go, a specification that allows to USB devices to act indifferently as Host or as a Client, depending on the device connected to the port
PCI-e	Peripheral Component Interface Express
PHY	Abbreviation of Physical, it is the device implementing the Physical Layer of ISO/OSI-7 model for communication systems
PSU	Power Supply Unit
PWM	Pulse Width Modulation
PWR	Power
RGMII	Reduced Gigabit Media Independent Interface, a particular interface defining the communication between an Ethernet MAC and a PHY
SATA	Serial Advance Technology Attachment, a differential half duplex serial interface for Hard Disks
SD	Secure Digital, a memory card type
SM Bus	System Management Bus, a subset of the I2C bus dedicated to communication with devices for system management, like smart batteries and other power supply-related devices
SPI	Serial Peripheral Interface, a 4-Wire synchronous full-duplex serial interface which contemplates a master and one or more slaves, individually enabled through a Chip Select line
TBM	To be measured
TMDS	Transition-Minimized Differential Signaling, a method for transmitting high speed serial data, normally used on DVI and HDMI interfaces
TTL	Transistor-transistor Logic
USB	Universal Serial Bus
uSDHC	Ultra Secure Digital Host Controller
V_REF	Voltage reference Pin

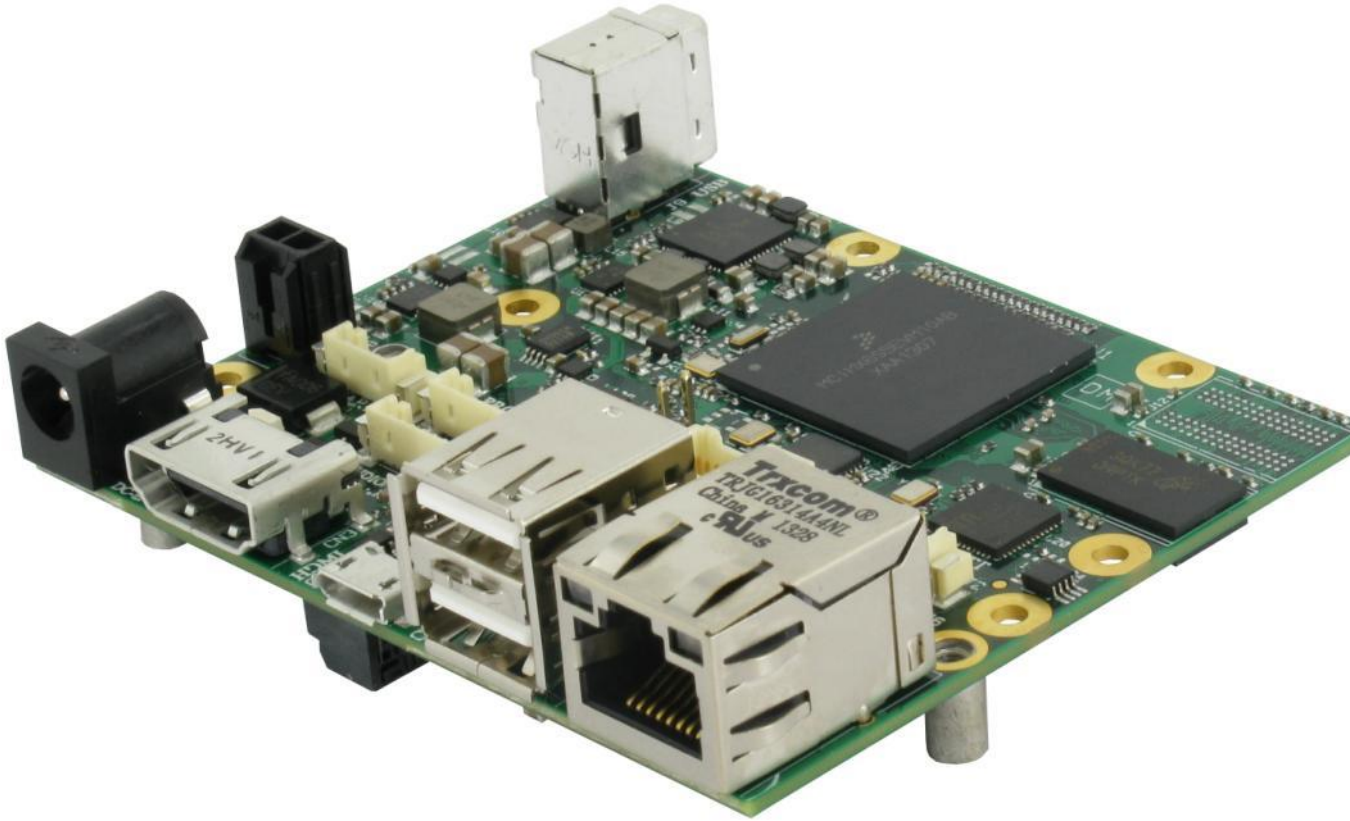
1.8 Reference specifications

Here below it is a list of applicable industry specifications and reference documents.

Reference	Link
AC'97	http://download.intel.com/support/motherboards/desktop/sb/ac97_r23.pdf
ACPI	http://www.acpi.info
AHCI	http://www.intel.com/content/www/us/en/io/serial-ata/ahci.html
CAN Bus	http://www.bosch-semiconductors.de/en/ubk_semiconductors/safe/ip_modules/can_literature/can_literature.html
CSI	http://www.mipi.org/specifications/camera-interface
DDC	http://www.vesa.org
Gigabit Ethernet	http://standards.ieee.org/about/get/802/802.3.html
HDMI	http://www.hdmi.org/index.aspx
I2C	http://www.nxp.com/documents/other/UM10204_v5.pdf
LVDS	http://www.ti.com/ww/en/analog/interface/lvds.shtml http://www.ti.com/lit/ml/snla187/snla187.pdf
MIPI	http://www.mipi.org
MMC/eMMC	http://www.jedec.org/committees/jc-649
OpenCL	http://www.khronos.org/opencl
OpenGL	http://www.opengl.org
OpenVG	http://www.khronos.org/openvg
PCI Express	http://www.pcisig.com/specifications/pciexpress
PCI Express mini cards	http://www.pcisig.com/specifications/pciexpress/specifications/specifications/pciexpress/base2/#MCEM2
SATA	https://www.sata-io.org
SD Card Association	https://www.sdcard.org/home
SM Bus	http://www.smbus.org/specs
TMDS	http://www.siliconimage.com/technologies/tmds
USB 2.0 and USB OTG	http://www.usb.org/developers/docs/usb_20_070113.zip
NXP i.MX6 processor	http://www.nxp.com/products/microcontrollers-and-processors/arm-processors/i.mx-applications-processors-based-on-arm-cores/i.mx-6-processors:IMX6X_SERIES?cof=0&am=0

Chapter 2.
OVERVIEW

- Introduction
- Technical specifications
- Electrical specifications
- Mechanical specifications
- Block diagram



2.1 Introduction

SBC-984 is a Single Board Computer, measuring just 80 x 67 mm (3.15” x 2.64”) based on embedded NXP i.MX6 processor, an ARM® Cortex®-A9 processor, Single-, Dual- and Quad-Core, with frequencies up to 1.2GHz, which is ideal for applications requiring multimedia capabilities and/or high levels of parallel computing maintaining advantages offered by low-power consuming ARM architecture in an extremely reduced space.

Graphics features of the board are managed directly by NXP i.MX6 processors, which integrate up to three separated accelerators for 2D, OpenGL® ES2.0 3D and OpenVG™, giving the processor incredible graphical performances (OpenVG™ accelerator is not available with i.MX6 Solo and Dual Lite processors).

The board is able to support up to 3 independent displays, which can be driven through the HDMI connector and/or the LVDS connector. LVDS interface is also able to drive one 18/24 bit Single / Dual Channel display as well as two independent 18/24 bit Single Channel displays. Using i.MX6 Dual Lite and Solo processors, support is limited to 2 independent displays.

The board is completed with up to 2GB DDR3 (up to 1GB with i.MX6 Solo) directly soldered on board, and one eMMC Flash Disk, directly accessible like any standard Hard Disk, with up to 8GB of capacity. Mass storage capabilities are completed by the half-length mSATA slot, which can also be used to host miniPCI-e cards.

RGMII i.MX6 native interface is internally carried to a Micrel KSZ9031RN Ethernet Transceiver, allowing the implementation of a Gigabit Ethernet interface.

USB native ports are carried to two USB2.0 USB Hub controllers, which allow implementing three standard USB 2-0 Type A ports, one USB OTG (micro-AB connector) and another internal USB port, intended for the connection of optional WiFi modules.

The features of this extremely versatile and compact board are completed by an AC’97 Audio Codec, which manages an internal LineOut and Min in connector, and one RS-232 Serial port.

It is possible to have the board in EXTREME version, where all the components mounted onboard are certified to work in industrial range, therefore the board is specifically developed to work in range -40°C ÷ +85°C..

Please refer to following chapter for a complete list of all peripherals integrated and characteristics.

2.2 Technical specifications

Processors

NXP i.MX6 Family, based on ARM® CORTEX-A9 processors
- i.MX6S Solo - Single core up to 1GHz
- i.MX6D Dual - Dual core up to 1.2GHz per core
- i.MX6DL Dual Lite - Dual core up to 1GHz per core
- i.MX6Q Quad - Quad core up to 1.2GHz per core

Memory

Up to 2GB DDR3l soldered onboard (up to 1GB with i.MX6S)

Graphics

Dedicated 2D Hardware accelerator
Dedicated 3D Hardware accelerator, supports OpenGL® ES2.0 3D
Dedicated Vector Graphics accelerator supports OpenVG™ (only i.MX6D and i.MX6Q)
Supports up to 3 independent displays with i.MX6D and i.MX6Q
Supports 2 independent displays with i.MX6DL and i.MX6S

Video Interface

1 x LVDS Dual Channel or 2 x LVDS Single Channel 18/24 bit interface
HDMI Interface
Video Input Port / Camera connector (only with PCB rev. C or higher)

Video Resolution

LVDS, up to 1920x1200
HDMI, up to 1080p

Mass Storage

Onboard eMMC Disk, up to 8 GB *
mSATA Half-length slot (shared with miniPCI-express)

** Please consider that for HDD and Flash Disk manufacturers, 1GB = 10^9 Byte. Some OS (like, for example, Windows) intends 1GB = 1024^3 byte, so global capacity shown for Disk Properties will be less than expected. Please also consider that a portion of disk capacity will be used by internal Flash Controller for Disk management, so final capacity will be lower*

USB

3 x standard USB 2.0 Type A
1 x USB OTG on micro-AB connector
Internal USB for optional WiFi module

Networking

Gigabit Ethernet connector

Audio

AC'97 Audio Codec
Mic In, Line out internal pin header connector

PCI Express

Half-mini PCI-e slot, shared with mSATA (only PCI-e 1.1 and Gen2 are supported)

Serial ports

1x RS-232 serial port
TTL debug UART (Tx, RX only)
CAN interface internal connector

Other Interfaces

I2C touch Connector
Internal connector for power and reset buttons

Power supply

+12VDC ± 10%
Embedded additional RTC circuitry for lowest power consumption
Optional RTC Battery with lead cable and connector

Operating temperature:

0°C ÷ +70°C** (commercial version)
-40°C ÷ +85°C (industrial version)

Dimensions: 80 x 67 mm (3.15" x 2.64").

Supported Operating Systems:

Linux

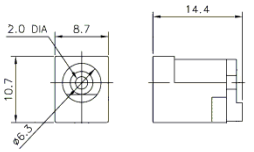
! *** is to be considered at any point of the heatspreader/heatsink. Actual temperature will widely depend on application, enclosure and/or environment. Upon customer to consider specific cooling solutions for the final system.*
Please also check paragraph 4.1

2.3 Electrical specifications

SBC-984 needs to be supplied only with an external $12V_{DC}$ ± 10% power supply.

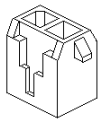
This voltage can be supplied through a standard 6.3mm (internal pin, diameter 2.0 mm) Power Jack.

Internal pin is V_{IN} power line.



Power In Connector - J8	
Pin	**Signal**
1	V_{IN}
2	GND

As an alternative, $+12V_{DC}$ can also be supplied using dedicated internal connector J8, which is a MOLEX "Micro-Fit 3.0™" 2-pin connector, p/n 43045-0212 or equivalent, 5A max current per contact, with pinout shown in the table on the left.



Mating connector: MOLEX 43025-0200 receptacle with MOLEX 43030 series of female crimp terminals.

2.3.1 Power Consumption

The power consumptions have been measured on +12VDC V_{IN} power line using the following modules configurationS:

- Quadmo747-X/i.MX6 module with i.MX6Q Quad - Quad Core processor @ 1GHz, 2GB DDR3L, 4GB eMMC, commercial temperature range
- Quadmo747-X/i.MX6 module with i.MX6DL Dual Lite - Dual Core processor @ 1GHz, 2GB DDR3L, 4GB eMMC, commercial temperature range
- Quadmo747-X/i.MX6 module with i.MX6S Solo- Single core processor @ 1GHz, 512MB DDR3L, 4GB eMMC, commercial temperature range

The File System installed onboard is iMX6_FS_ubuntu-minimal_v4.0.4.tar.gz

The measures have been performed in the following situations:

IDLE: System powered and turned on, without tasks in execution. HDMI display connected, at Full HD resolution. No network connection.

VPU: HDMI display connected, at Full HD resolution, displaying a 1080p @ 30fps video. No network connection.

GPU: HDMI display connected, displaying the tutorial7 demo available in folder /opt/viv_sample/vdk. No network connection.

VPU + GPU: The previous two situations combined together.

PCIe: System powered and turned on. HDMI display connected, at Full HD resolution. WiFi card DHXA-195 plugged on miniPCI-e slot (scanning for Wi-Fi networks).

mSATA: System powered and turned on. HDMI display connected, at Full HD resolution. 16GB Half-size mSATA disk plugged (continuous data transfer).

CPU 50%: System powered and turned on. HDMI display connected, at Full HD resolution. Half of the cores working at 100% (i.e., 2 cores working at 100% on i.MX6Q, 1 core working at 100% on i.MX6DL)

CPU 100%: System powered and turned on. HDMI display connected, at Full HD resolution. All cores working at 100%.

Network: System powered and turned on. HDMI display connected, at Full HD resolution. Iperf tool testing bidirectional Ethernet connection.

Stress Test: tests VPU, GPU, CPU 100% and Network performed simultaneously

The power consumption measurements excluded the USB ports, the LVDS display, the camera interface, the CAN interface and the RS-232 transceiver.

Test	Processor		
	i.MX6S	i.MX6DL	i.MX6Q
IDLE	1.94W	2.2W	2.39W
VPU	2.6W	2.9W	3.16W
GPU	3.61W	4.48W	6.38W
VPU + GPU	3.61W	4.8W	6.28W
PCIe	3.6W	4.04W	3.7W
mSATA	---	---	3.34W
CPU 50%	---	3.01W	4.35W
CPU 100%	2.96W	3.83W	5.94W
Network	3.3W 170 Mbits/sec RX 130Mbits/sec TX	4.05W 270 Mbits/sec RX 140Mbits/sec TX	4.3W 270 Mbits/sec RX 140Mbits/sec TX
Stress test	4.69W	6.11W	9.81W

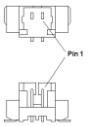
2.3.2 RTC Battery

For the occurrences when the module is not powered with an external power supply, it is possible to connect a cabled coin 3V Lithium Battery to supply the Real Time Clock embedded inside i.MX6 Processor. Such a battery is optional. Please also check par. 4.2.3.

Battery used is a cabled CR2032-LD Lithium coin-cell battery, with a nominal capacity of 220mAh.

Battery connector - J2	
Pin	**Signal**
1	V_{RTC}
2	GND

The battery is not rechargeable, and can be connected to the board using dedicated connector J2 which is a 2-pin p1.27 mm type MOLEX p/n 53398-0271 or equivalent, with pinout shown in the table on the left.



Mating connector: MOLEX 51021-0200 receptacle with MOLEX 50079-8000 female crimp terminals.

In case of exhaustion, the battery should only be replaced with devices of the same type. Always check the orientation before inserting and make sure that they are aligned correctly and are not damaged or leaking.

Never allow the batteries to become short-circuited during handling.

! **CAUTION**: handling batteries incorrectly or replacing with not-approved devices may present a risk of fire or explosion.

Batteries supplied with SBC-984 are compliant to requirements of European Directive 2006/66/EC regarding batteries and accumulators. When putting out of order SBC-984, remove the batteries from the board in order to collect and dispose them according to the requirement of the same European Directive above mentioned. Even when replacing the batteries, the disposal has to be made according to these requirements.

2.3.3 Power rails naming convention

In all the tables contained in this manual, Power rails are named with the following meaning:

_S: Switched voltages, i.e. power rails that are active only when the board is in ACPI's S0 (Working) state. Examples: +3.3V_S, +5V_S.

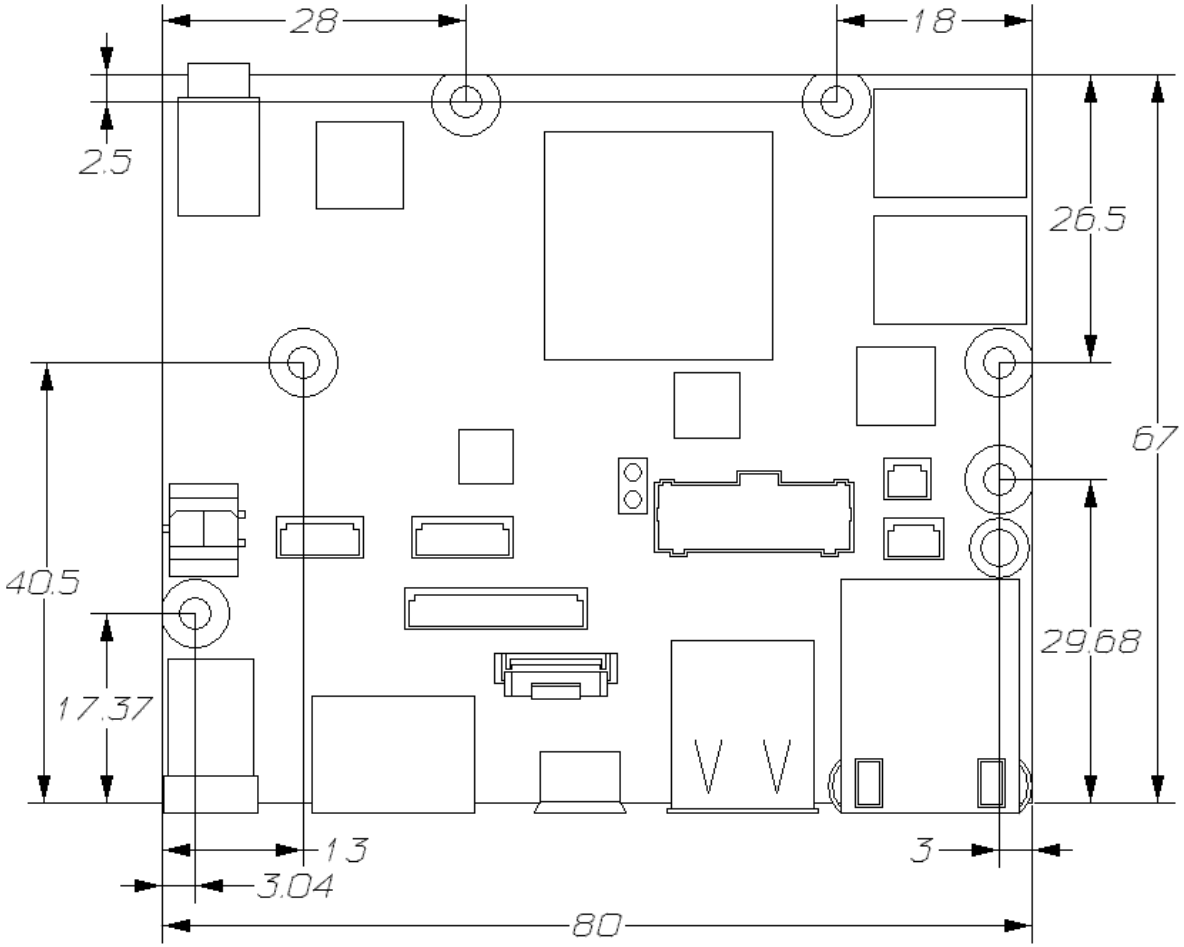
_A: Always-on voltages, i.e. power rails that are active both in ACPI's S0 (Working), S3 (Standby) and S5 (Soft Off) state. Examples: +5V_A, +3.3V_A.

Other suffixes are used for application specific power rails, which are derived from same voltage value of voltage switched rails, if it is not differently stated (for example, $+5V_{HDMI}$ is derived from +5V_S, and so on).

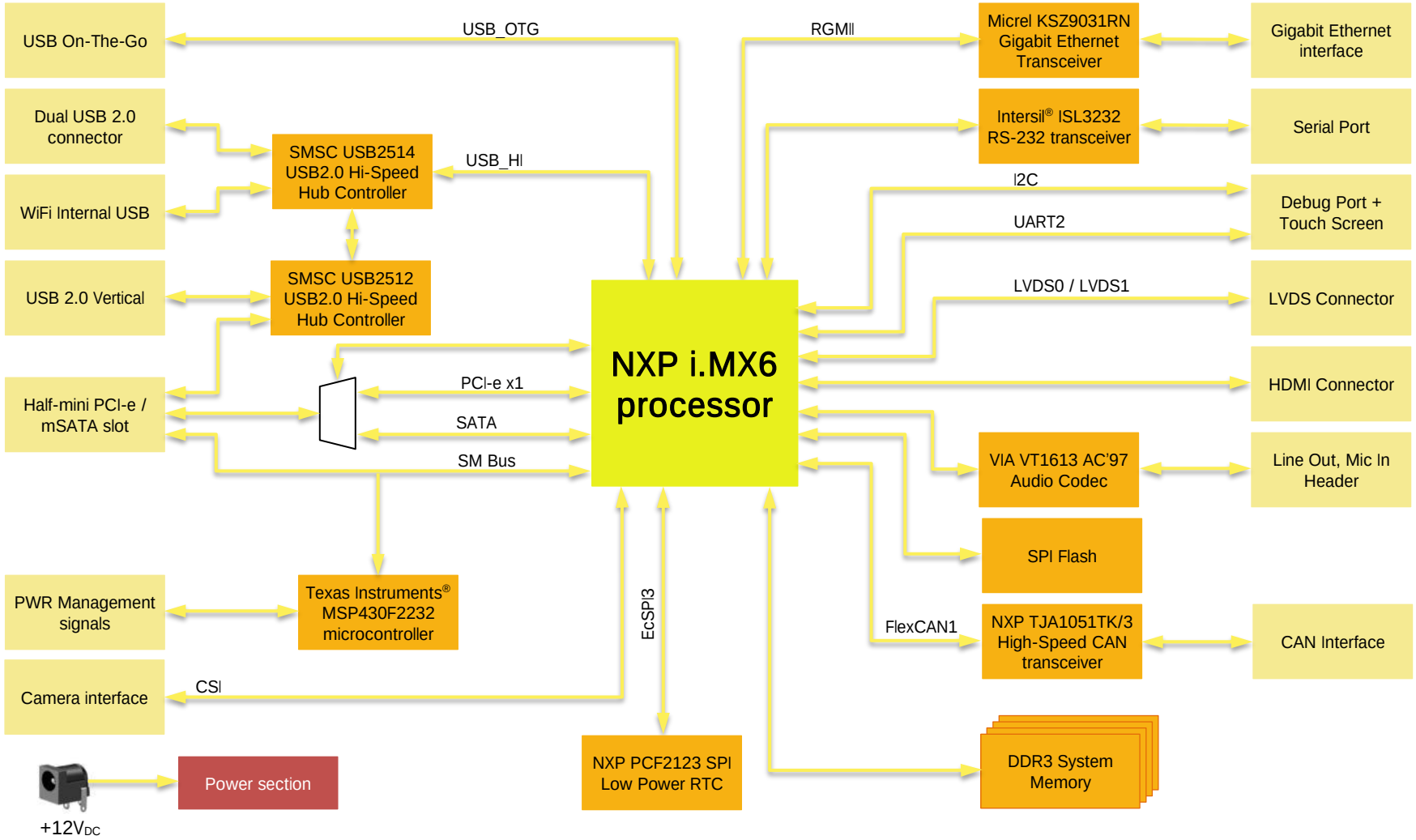
2.4 Mechanical specifications

Board dimensions are 80 x 67 mm (3.15” x 2.64”).

The printed circuit of the board is made of twelve layers, some of them are ground planes, for disturbance rejection.

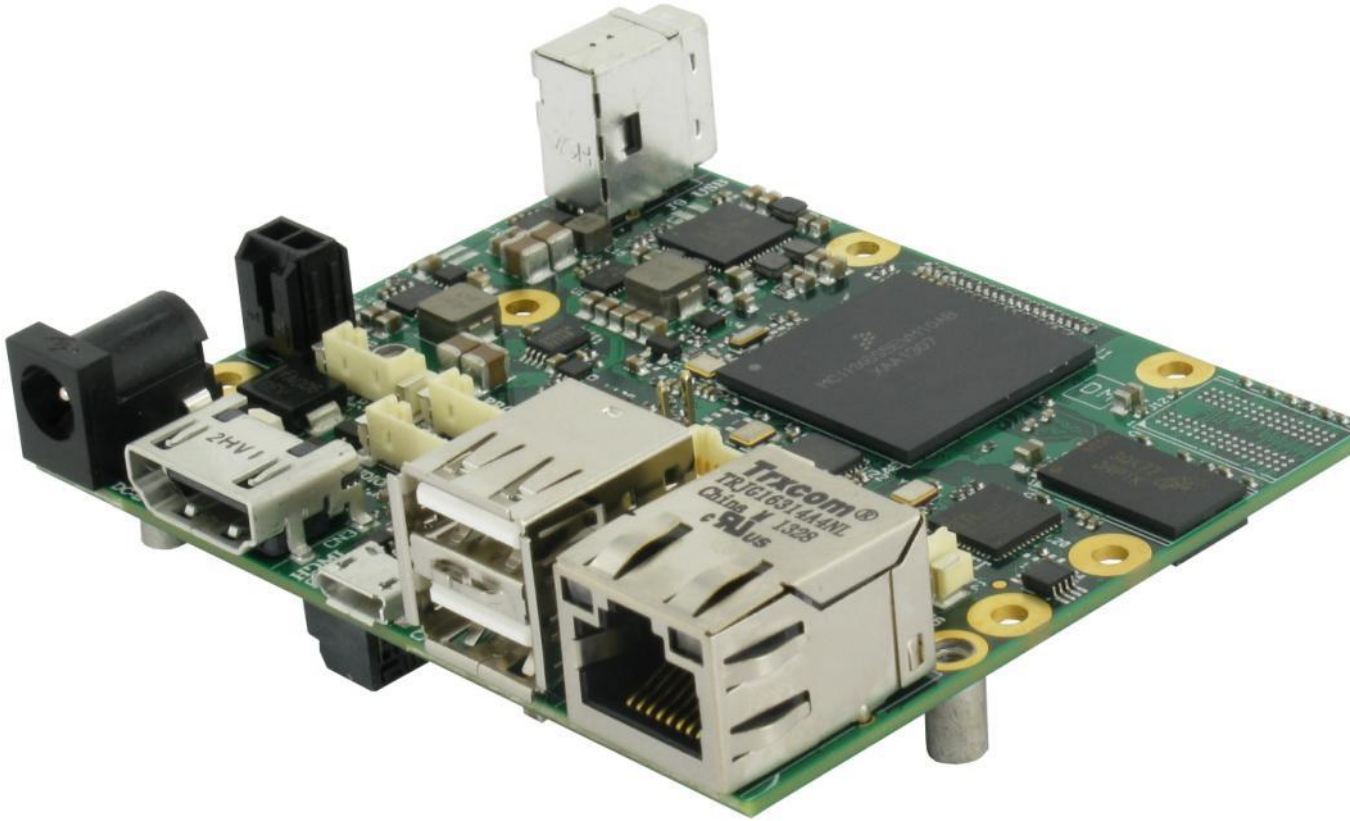


2.5 Block diagram



Chapter 3.
CONNECTORS

- Introduction
- Connectors overview
- Connectors description

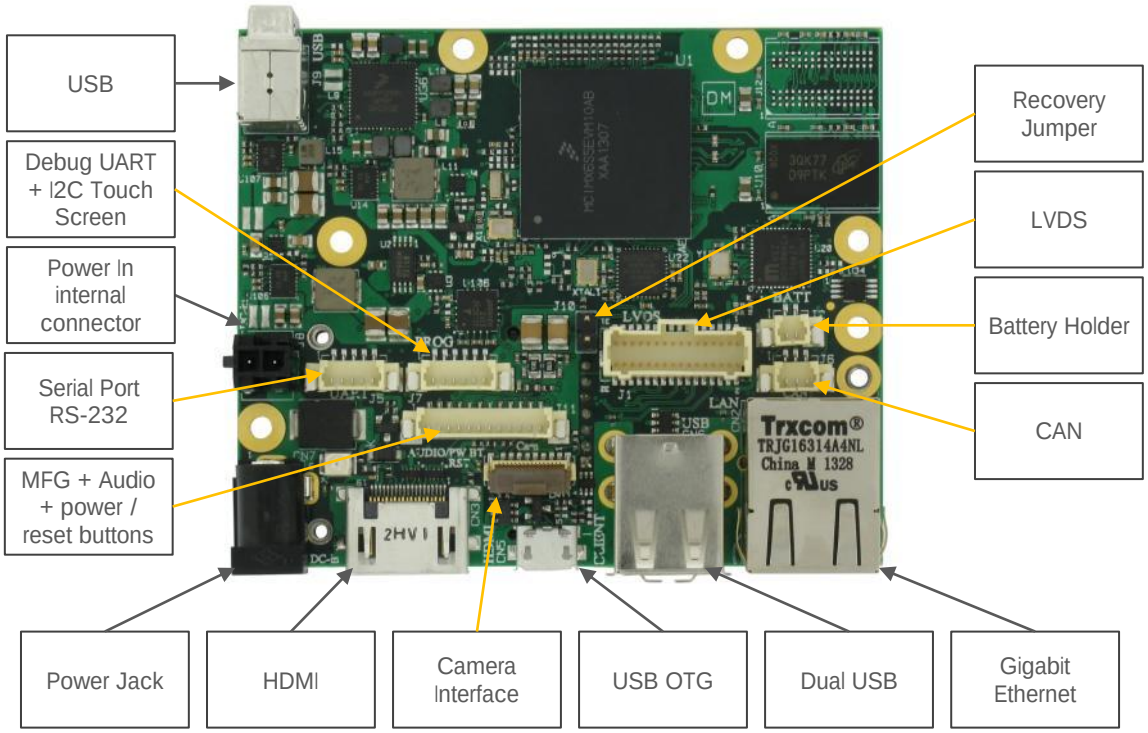


3.1 Introduction

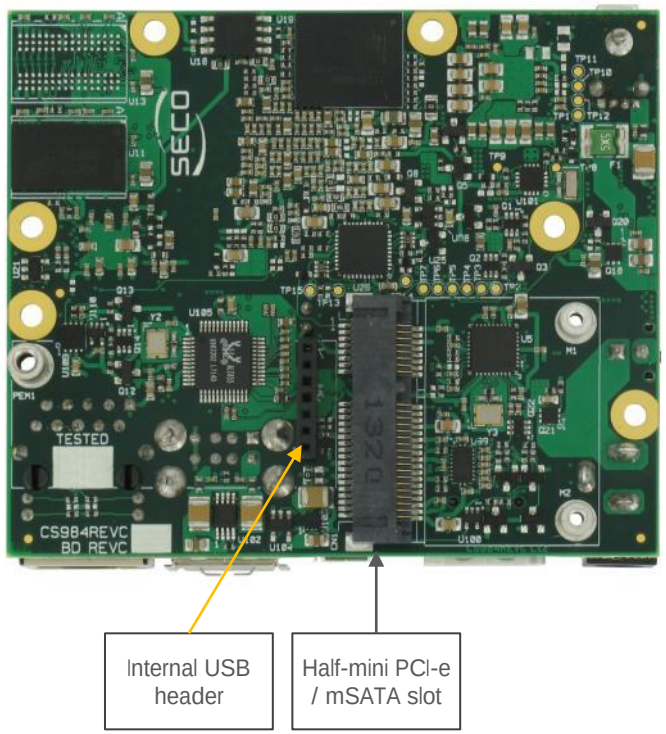
On SBC-984 board, there are several connectors located on the upper plane. Standard connectors are placed on the same side of PCB, so that it is possible to place them on a panel of an eventual enclosure.

> **!** Please be aware that, depending on the configuration purchased, the appearance of the board could be slightly different from the following pictures.

TOP SIDE



BOTTOM SIDE



3.2 Connectors overview

Name	Description	Name	Description
CN1	Half-mini PCI-e / mSATA slot	J2	RTC battery holder
CN2	Gigabit Ethernet port	J5	Serial port RS-232
CN3	HDMI connector	J6	CAN bus connector
CN4	Internal USB header for WiFi module	J7	Debug UART / I2C Touch Connector
CN5	USB OTG micro-AB connector	J8	Auxiliary Power In connector
CN6	USB 2.0 type A ports #1 / #2	J9	USB 2.0 port type A vertical connector
CN7	Power In Jack	J10	Recovery Jumper
CN11	Camera connector (only PCB rev. C or higher)	J11	MFG + Audio + Power/Reset buttons connector
J1	LVDS connector		

3.3 Connectors description

3.3.1 LVDS + backlight connector

Embedded into NXP i.MX6 processor there is an LVDS Display Bridge, connected to the Image Processing Unit (IPU), that makes externally available two LVDS channels, each one consisting of 1 clock pair and four data pairs.

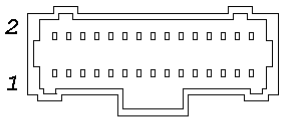
LVDS connector - J1

Pin	Signal	Pin	Signal
1	V_{IN}	2	V_{IN}
3	$+3.3V_{LCD}$	4	$+5V_{LCD}$
5	$+3.3V_{LCD}$	6	$+5V_{LCD}$
7	LVDS1_TX0-	8	LVDS0_TX0-
9	LVDS1_TX0+	10	LVDS0_TX0+
11	LVDS1_TX1-	12	LVDS0_TX1-
13	LVDS1_TX1+	14	LVDS0_TX1+
15	LVDS1_TX2-	16	LVDS0_TX2-
17	LVDS1_TX2+	18	LVDS0_TX2+
19	LVDS1_TX3-	20	LVDS0_TX3-
21	LVDS1_TX3+	22	LVDS0_TX3+
23	GND	24	GND
25	LVDS1_CLK-	26	LVDS0_CLK-
27	LVDS1_CLK+	28	LVDS0_CLK+
29	LVDS_BLT_EN	30	LVDS_BLT_CTRL
31	GND	32	GND

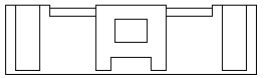
It is possible to configure LVDS output so that it can be used as:

- One single channel (18 or 24 bit) output, max resolution supported 1366 x 768 @ 60fps
- One dual channel (18 or 24 bit) output, max resolution supported 1920 x 1200 @ 60fps
- Two identical single channel outputs, max resolution supported 1366 x 768 @ 60fps
- Two independent single channel outputs, max resolution supported 1366 x 768 @ 60fps on each channel

All of these possibilities come by opportunely configuring the O.S. installed on the module.



For the connection, a connector type HR A1014WVA-S-2x16P or equivalent (2 x 16p, male, straight, P1, low profile, polarized) is provided, with the pin-out shown in the table on the left.



Mating connector: HR A1014H-2X16P with HR A1014-T female crimp terminals.

On the same connectors, are also implemented signals for direct driving of display's backlight: voltages (V_{IN}, directly coming from external PSU, $+5V_{LCD}$ and $+3.3V_{LCD}$) and control signals (Backlight enable signal, LVDS_BKLT_EN, and Backlight Brightness Control signal, LVDS_BLT_CTRL).

When building a cable for connection of LVDS displays, please take care of twist as tight as possible differential pairs' signal wires, in order to reduce EMI interferences. Shielded cables are also recommended.

Here following the signals related to LVDS management:

LVDS0_TX0+/LVDS0_TX0-: LVDS Channel #0 differential data pair #0.

LVDS0_TX1+/LVDS0_TX1-: LVDS Channel #0 differential data pair #1.

LVDS0_TX2+/LVDS0_TX2-: LVDS Channel #0 differential data pair #2.

LVDS0_TX3+/LVDS0_TX3-: LVDS Channel #0 differential data pair #3.

LVDS0_CLK+/LVDS0_CLK-: LVDS Channel #0 differential Clock.

LVDS1_TX0+/LVDS1_TX0-: LVDS Channel #1 differential data pair #0.

LVDS1_TX1+/LVDS1_TX1-: LVDS Channel #1 differential data pair #1.

LVDS1_TX2+/LVDS1_TX2-: LVDS Channel #1 differential data pair #2.

LVDS1_TX3+/LVDS1_TX3-: LVDS Channel #1 differential data pair #3.

LVDS1_CLK+/LVDS1_CLK-: LVDS Channel #1 differential Clock.

LVDS_BLT_EN: +3.3V_S electrical level Output, Panel Backlight Enable signal. It can be used to turn On/Off the backlight's lamps of connected LVDS display.

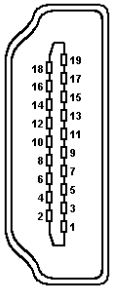
LVDS_BLT_CTRL: this signal can be used to adjust the backlight brightness in displays supporting Pulse Width Modulated (PWM) regulations (+3.3V_S electrical level).

3.3.2 HDMI connector

In addition to LVDS interface, NXP i.MX6 processor also has an embedded HDMI Tx module, which provides a HDMI standard interface for HDMI1.4a compliant displays. By using HDMI interface along with two LVDS single channel interfaces, it is possible to drive up to 3 independent displays.

HDMI Connector - CN3			
Pin	**Signal**	**Pin**	**Signal**
1	TMDS_LANE2+	2	GND
3	TMDS_LANE2-	4	TMDS_LANE1+
5	GND	6	TMDS_LANE1-
7	TMDS_LANE0+	8	GND
9	TMDS_LANE0-	10	TMDS_CLK+
11	GND	12	TMDS_CLK-
13	CEC	14	N.C.
15	SCL	16	SDA
17	GND	18	$+5V_{HDMI}$
19	HPD		

For this reason, on SBC-984 board there is the possibility of connecting directly one HDMI display, using a certified HDMI connector type A, model Hirose p/n MD60-19P.



Signals involved in HDMI management are the following:

TMDS_CLK+/TMDS_CLK-: TMDS differential Clock.

TMDS_LANE0+/TMDS_LANE0-: TMDS differential pair #0

TMDS_LANE1+/TMDS_LANE1-: TMDS differential pair #1

TMDS_LANE2+/TMDS_LANE2-: TMDS differential pair #2

SDA: DDC Data line for HDMI panel. Bidirectional signal, electrical level $+5V_{HDMI}$ with a 2k7Ω pull-up resistor.

SCL: DDC Clock line for HDMI panel. Output signal, electrical level $+5V_{HDMI}$ with a 2k7Ω pull-up resistor.

CEC: HDMI Consumer Electronics Control (CEC) Line. Bidirectional signal, electrical level $+5V_{HDMI}$ with 2k7Ω pull-up resistor.

HPD: Hot Plug Detect Input signal. $+5V_{HDMI}$ with 20kΩ pull-down resistor.

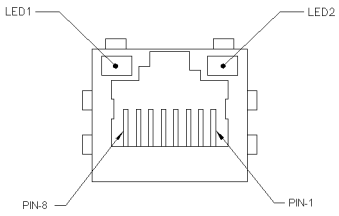
For ESD protection, on all data and voltage lines are placed clamping diodes for voltage transient suppression.

Always use HDMI-certified cables for the connection between the board and the HDMI display; a category 2 (High-Speed) cable is recommended for higher resolutions, category 1 cables can be used for 720p resolution.

3.3.3 Ethernet connector

Gigabit Ethernet Port - CN2			
Pin	**Signal**	**Pin**	**Signal**
1	GBE0_MDI0+	5	GBE0_MDI2-
2	GBE0_MDI0-	6	GBE0_MDI1-
3	GBE0_MDI1+	7	GBE0_MDI3+
4	GBE0_MDI2+	8	GBE0_MDI3-

On board, there is one Gigabit Ethernet connector, made available by a Micrel KSZ9031RN Gigabit Ethernet Transceiver interfaced to NXP processor's RGMII interface.



Connector is type LINK-PP p/n LPJG16314A4NL or equivalent, with 2kV decoupling capacitor, 100 Ohm impedance.

On the connectors there are also two bicolor Green/Yellow LEDs: LED1 (Left LED) shows 10/100 or 1000 connection: yellow means 100Mbps connection, green means 1000Mpbs connection, when the LED is Off then 10Mpbs or no connection is available. LED2 (Right LED) is not working.

This interface is compatible both with Gigabit Ethernet (1000Mbps) and with Fast Ethernet (10/100Mbps) Networks. It will configure automatically to work with the existing network. Theoretical maximum speed of 1Gbps, however, cannot be reached, due to a known limitation of i.MX6 Gb Ethernet MAC (ENET), which is limited only to 470Mbps (also check NXP Errata ERR004512 for i.MX6 processors).

Please be aware that they will work in Gigabit mode only in case that they are connected to Gigabit Ethernet switches/hubs/routers. For the connection, cables category Cat5e or better are required. Cables category Cat6 are recommended for noise reduction and EMC compatibility issues, especially when the length of the cable is significant.

GBE0_MDI0+/GBE0_MDI0-: Ethernet Controller Media Dependent Interface (MDI) I/O differential pair #0. It is the first differential pair in Gigabit Ethernet mode, and the Transmit differential pair in 10/100 Mbps modes.

GBE0_MDI1+/GBE0_MDI1-: Ethernet Controller Media Dependent Interface (MDI) I/O differential pair #1. It is the second differential pair in Gigabit Ethernet mode, and the Receive differential pair in 10/100 Mbps modes.

GBE0_MDI2+/GBE0_MDI2-: Ethernet Controller Media Dependent Interface (MDI) I/O differential pair #2. It is the third differential pair in Gigabit Ethernet mode; it is not used in 10/100Mbps modes.

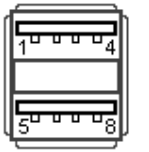
GBE0_MDI3+/GBE0_MDI3-: Ethernet Controller Media Dependent Interface (MDI) I/O differential pair #3. It is the fourth differential pair in Gigabit Ethernet mode; it is not used in 10/100Mbps modes.

3.3.4 USB ports

Double USB 2.0 type A receptacle - CN6			
Pin	**Signal**	**Pin**	**Signal**
1	$+5V_{USB1}$	5	$+5V_{USB2}$
2	USB_P1-	6	USB_P2-
3	USB_P1+	7	USB_P2+
4	GND	8	GND

Lined to the ETHERNET connector, there is a double USB connector, CN6, which is a standard double USB Type A socket, shielded. It carries out USB ports #1 and #2 coming out from SMSC USB2514 USB 2.0 Hi-Speed Hub Controller

Since this connector is a standard type-A receptacle, it can be connected to all types of USB 1.1 / USB 2.0 devices using Standard-A USB 3.0 or USB 2.0 plugs.



USB internal pin header - CN4	
Pin	**Signal**
1	+3V_A
2	+5V_A
3	USB_P4+
4	USB_P4-
5	GND
6	N.C.
7	N.C.

Port #4 of the same USB hub is carried to an internal female pin Header, located on the bottom of the board, which is intended for the connection of optional WiFi module (obviously, it can also be used as a standard USB2.0 port). Please check also par. 4.2.2 for further details about this module

Pin Header is a standard 7-pin p 2.54 mm female header, h=4.5mm, with the pinout shown in the table on the left.

USB connector - J9	
Pin	**Signal**
1	+5V_S
2	USB_H2-
3	USB_H2+
4	GND

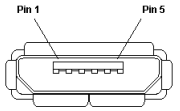
Port#3 of SMSC USB2514 Hub controller is used to drive a second USB Hub, which makes available two further USB 2.0 ports.

One of them (port #1, let's name it USB_H1) is carried to miniPCI-e / mSATA slot, which is documented in paragraph 3.3.6.

The other USB port (port #2, let's name it USB_H2) is carried out on an additional USB Type A connector, which is available on the "rear" side of the board, on a vertical, right-angle, standard USB Type A socket.

Micro-AB USB connector - CN5	
Pin	**Signal**
1	$+5V_{CLIENT}$
2	USB_OTG-
3	USB_OTG+
4	USB_ID
5	GND

Finally, USB On-The-Go interface, native for NXP i.MX6 processor, is carried out through a standard micro-AB connector, described in the table on the left.



Depending on the needed use of SBC-984 board, it is necessary to connect micro-A or micro-B USB cables to connector CN5.

When a micro-A USB cable is used, since its USB_ID pin is tied to GND, then the board configures itself to work as a Host. In this case, $+5V_{CLIENT}$ is a power output of SBC-984 board for the connected device.

When a micro-B USB cable is used, its USB_ID pin is floating; this way, the board acknowledges that it must configure itself to work as a Client. In this case, $+5V_{CLIENT}$ is a power input of SBC-984 board from the external Host.

Signals description:

USB_P1+/USB_P1-: USB Port #1 differential pair; it is managed SMS USB 2514 USB Hub controller Downstream Port #1.

USB_P2+/USB_P2-: USB Port #2 differential pair; it is managed SMS USB 2514 USB Hub controller Downstream Port #2.

USB_P4+/USB_P4-: USB Port #4 differential pair; it is managed SMS USB 2514 USB Hub controller Downstream Port #4.

USB_H2+/USB_H2-: Secondary USB Port #2 differential pair; it is managed by SMSC USB2412 secondary USB Hub controller, Downstream Port #2.

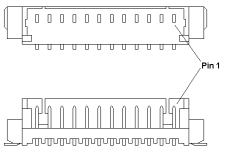
USB_OTG-/USB_OTG+: USB OTG differential pair, directly managed by NXP i.MX6 USB OTG port.

USB_ID: USB Identification pin. It is the signal used in the micro-AB connectors to differentiate between micro-A cables (to be used for Host connection) and micro-B cables (to be used for Client connection).

3.3.5 MFG + Audio + Power/Reset buttons connector

MFG + Audio + Power/Reset buttons connector - J11			
Pin	**Signal**	**Pin**	**Signal**
1	MSP_TEST	7	Audio_GND
2	MSP_RST	8	Line_Out_Right
3	GND	9	GND
4	Mic_In	10	PWR_BTN#
5	Audio_GND	11	RST_BTN#
6	Line_Out_Left	12	+3.3V_S

In order to reduce the space dedicated to connectors, SBC-984 board doesn't offer any standard audio jack.



However, SBC-984 integrates an AC'97 Audio Codec (Realtek ALC655 for commercial version, stariing from PCB revision C, and Wolfson WM9707 for industrial version), which makes basic audio connection available on dedicated connector J4, which is a 9-pin single line SMT connector, type MOLEX 53398-1271 or equivalent.

Mating connector: MOLEX 51021-1200 receptacle with MOLEX 50079-8000 female crimp terminals.

Using this dedicated connector, it will be possible to connect any audio jack to remote audio connectors in the preferred position.

Moreover, in the same connector are also carried the signals for managing external Power and Reset Button, to be used to turn On / Off and reset the board.

SECO can provide for an adapter cable with two audio jacks and two pushbuttons already connected. Please check par. 4.2.5.

Pinout of this connector is shown in the table above.

Here following the signals' description:

Mic_In: Audio Microphone Channel.

Line_Out_Left: Audio Line Out Left Channel.

Line_Out_Right: Audio Line Out Right Channel.

PWR_BTN#: Power Button Input, active low +3.3V_A electrical voltage signal, with 10kΩ pull-up resistor. When working in ATX mode, this signal can be connected to a momentary push-button: a pulse to GND of this signal will switch power supply On or Off.

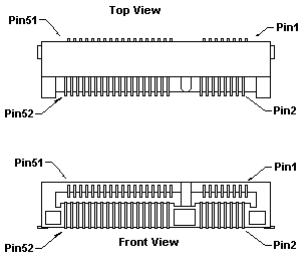
RST_BTN#: Reset Button Input, active low +3.3V_S electrical voltage signal, with 10kΩ pull-up resistor. This signal can be connected to a momentary push-button: a pulse to GND of this signal will reset the SBC-984 board.

Finally, this same connector carries out two signals (MSP_TEST and MSP_RST) that are used for manufacturing purposes, and shall therefore not be used by the customer.

3.3.6 Half-mini PCI-express / mSATA slot

miniPCI-express Slot - CN1			
Pin	**Signal**	**Pin**	**Signal**
1	PCIE_WAKE#	2	+3.3V_A
3	N.C.	4	GND
5	N.C.	6	+1.5V_S
7	N.C.	8	N.C.
9	GND	10	N.C.
11	PCIE_CLK_REF-	12	N.C.
13	PCIE_CLK_REF+	14	N.C.
15	GND	16	N.C.
17	N.C.	18	Slot_ENABLE#(*)
19	N.C.	20	N.C.
21	GND	22	PCIE_RST#
23	PCIe0_RX- / SATA_Rx+	24	+3.3V_A
25	PCIe0_RX+ / SATA_Rx-	26	GND
27	GND	28	+1.5V_S
29	GND	30	SMB_CLK
31	PCIe0_TX- / SATA_Tx-	32	SMB_DAT
33	PCIe0_TX+ / SATA_Tx+	34	GND
35	GND	36	USB_H1-
37	GND	38	USB_H1+
39	+3.3V_A	40	GND
41	+3.3V_A	42	N.C.
43	mSATA_SEL(*)	44	N.C.
45	N.C.	46	N.C.
47	N.C.	48	+1.5V_S
49	N.C.	50	GND
51	N.C.	52	+3.3V_A

In order to expand the possibilities offered by SBC-984 board, it is available a half-mini PCI-express Slot, which can also be used to connect mSATA Solid State Disks.



The connector is CN1, which is a standard 52pin miniPCI Express connector, type JAE MM60-52B1-E1-R650 or equivalent, H=5.9mm, with the pinout shown in the table on the left.

PCI express Gen 2.0 (5Gbps) is supported. Of the previous generation, only PCI express 1.1 is supported.

On the same connector, PCI Express is muitiplexed with SATA interface (which is a SATA II, 3.0 Gbps interface); please notice that SATA is available only with i.MX6 Quad and i.MX6 Dual versions, not with i.MX6 Solo or i.MX6 Dual Lite

Signals carried to miniPCI-express/mSATA slot are the following:

PCIE0_TX+/PCIE0_TX-: PCI Express lane #0, Transmitting Output Differential pair, multiplexed with SATA Transmitting Output Differential pair

PCIE0_RX+/PCIE0_RX-: PCI Express lane #0, Receiving Input Differential pair, multiplexed with SATA Receive Input Differential pair

PCIE_CLK_REF+ / PCIE_CLK_REF+: PCI Express Reference Clock, Differential Pair

PCIE_WAKE#: Board's Wake Input, it must be externally driven by the module inserted in the slot when it requires waking up the system.

PCIE_RST#: Reset Signal that is sent from SBC-984 board to the miniPCI-e module. It is a 3.3V active-low signal.

SATA_TX+/SATA_TX-: Serial ATA Channel #0 Transmit differential pair, multiplexed with PCI Express Lane#0 Transmitting Output Differential pair

SATA0_RX+/SATA0_RX-: Serial ATA Channel #0 Receive differential pair, multiplexed with PCI Express Lane#0 Receive Output Differential pair

SMB_CLK: SM Bus control clock line for System Management. Output signal, electrical level +3.3V_S with a 4k7Ω pull-up resistor.

SMB_DAT: SM Bus control data line for System Management. Bidirectional signal, electrical level +3.3V_S with a 4k7Ω pull-up resistor.

USB_H1+ / USB_H1-: Secondary USB Port #1 differential pair; it is managed by SMSC USB2412 secondary USB Hub controller, Downstream Port #1.

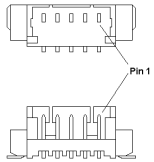
Slot_ENABLE#: this signal allows setting in high-impedance state the differential pairs available on pins 23/25 and 31/33. When signal is LOW, then normal operation of the slot is enabled, and selection between miniPCI Express and mSATA working mode is made using signal mSATA_SEL. When Slot_ENABLE# signal is HIGH, then these interfaces on the slot are disabled and power consumption is reduced. Please consider that even if these interfaces are disabled, the slot can still be used with USB interface. Input signal, electrical level +3.3V_S with a 33kΩ pull-up resistor. Enabling of these interfaces is automatic upon insertion of miniPCI-e or mSATA modules, since both of them, according to respective specifications, must tie this pin to GND.

mSATA_SEL: this signal is needed for selection between SATA and PCI-express interface: when mSATA_SEL is LOW, then PCI-express is available. When mSATA_SEL is HIGH, then SATA interface is available. Input signal, electrical level +3.3V_S with a 33kΩ pull-up resistor. Selection is automatic since, according to their respective specifications, miniPCI-express modules have to tie to GND this signal, while mSATA modules must left it unconnected (this means that the signal goes automatically high, due to on-board pull-up).

3.3.7 Serial port RS-232

RS-232 Interface - J5	
Pin	**Signal**
1	TX
2	RX
3	---
4	CTS#
5	GND

NXP i.MX6 processor offers some native serial ports. On SBC-984 board, one of them (UART5) is used for external communications.



Electrical interface of such a port is TTL, for this reason on the board has been integrated an RS-232 transceiver, which gives the possibility (through a simple adapter cable) to connect the serial port to standard COM ports, like those available on common Desktop PCs and other devices.

This serial port is accessible through a 5-pin connector, type MOLEX p/n 53398-0571 or equivalent.

Mating connector: MOLEX 51021-0500 receptacle with MOLEX 50079-8000 female crimp terminals.

If neededy, SECO can provide for a DB-9 male adapter cable for direct connection of RS-232 peripherals. Please check par. 4.2.5.

Signals' description:

TX: Serial port Interface, data transmit line, ± 15kV ESD Protected, RS-232 level transmitter output.

RX: Serial port interface, data receive line, ± 15kV ESD Protected, RS-232 compatible receiver input.

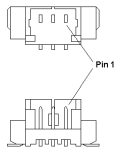
3.3.8 CAN Bus connector

Since i.MX6 processor includes a Flexible Controller Area Network (FlexCAN), on SBC-984 board it has been implemented also a CAN transceiver, for the direct connection of the board to a CAN Bus network.

CAN Bus Connector - J6	
Pin	**Signal**
1	CAN_H
2	GND
3	CAN_L

This interface is compliant to CAN specifications rel. 2.0 part B. The transceiver used is designed for high-speed (up to 1Mbps) CAN applications, and also offers improved EMC and ESD performances.

CAN Bus Connector is a 3-pin single line SMT connector, type MOLEX 53261-0371 or equivalent, with pinout shown in the table on the left. Mating connector: MOLEX 51021-0300 receptacle with MOLEX 50079-8000 female crimp terminals.



CAN_H: High-Level CAN bus line.

CAN_L: Low-Level CAN bus line.

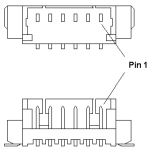
A 120Ω termination resistor is placed between CAN_H and CAN_L signals. It can be connected or disconnected from the line by using an analog switch, which is managed via SW.

If necessary, SECO can provide for a DB-9 male adapter cable for direct connection of the module to an existing CAN Bus line. Please check par. 4.2.5.

3.3.9 Debug UART / I2C Touch Connector

Debug UART / I2C Touch Connector - J7	
Pin	**Signal**
1	+3.3V_A
2	I2C3_SCL
3	I2C3_SDA
4	GND
5	UART2_RX / TOUCH_IRQ
6	UART2_TX / TOUCH_RST#

Onboard, connector J7 is a mixed signals connector, which carries out signals related to Debug Serial Port, which is managed by NXP i.MX6 UART2 internal controller, with signals available at TTL level. Along with an I2C interface available on this same connector, the UART pins can also be used for I2C Touch Screen controller connection, depending on the BSP programming.



The connector is a 6-pin MOLEX p/n 53398-0671 or equivalent, with pinout shown in the table on the left. Mating connector: MOLEX 51021-0500 receptacle with MOLEX 50079-8000 female crimp terminals.

Signals' description:

I2C3_SCL: I2C Bus clock line. Bidirectional signal, electrical level +3.3V_S with a 4k7Ω pull-up resistor. It is managed by i.MX6 processor's I2C3 controller.

I2C3_SDA: I2C Bus data line. Bidirectional signal, electrical level +3.3V_S with a 4k7Ω pull-up resistor. It is managed by i.MX6 processor's I2C3 controller.

UART2_TX / TOUCH_IRQ: UART2 Interface, Serial data Transmit (output) line, 3.3V_S electrical level. Can be used as IRQ line for Touch Screen connection.

UART2_RX / TOUCH_RST#: UART2 Interface, Serial data Receive (input) line, 3.3V_S electrical level. Can be used as Reset signal for Touch Screen connection.

Please consider that UART debug interface is at TTL electrical level; therefore, please evaluate well the typical scenario of application. If it isn't explicitly required to

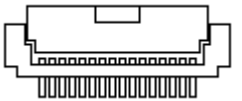
interface directly at TTL level, for connection to standard serial ports commonly available (like those offered by common PCs, for example) it is necessary to use an RS-232 transceiver module. SECO can provide such an adapter, which is part of optional accessories of the board. Please also check paragraph 4.2.1.

3.3.10 Camera connector

Camera connector - CN11			
Pin	**Signal**	**Pin**	**Signal**
1	CSI_DATA1-	9	CSI_DATA0+
2	CSI_DATA1+	10	GND
3	GND	11	PWRON
4	GND	12	MCLK
5	CSI_CLK-	13	I2C3_SCL
6	CSI_CLK+	14	I2C3_SDA
7	GND	15	RESET
8	CSI_DATA0-	16	+3.3V_S

NXP i.MX6 Processor includes an Image Processing Subsystem, that can be used for video applications, like video-preview, video recording and frame grabbing.

Starting from revision C of the PCB of SBC-984 board, it is possible to access to the video input port through an FFC/FPC connector, type HIROSE p/n FH12-16S-0.5SV(55) which is able to accept 16 poles 0.5mm pitch FFC cables.



The pinout of this connector is shown in the table on the left.

Signals' description

CSI_DATA0-/CSI_DATA0+: CSI first input differential pair. It is managed by i.MX6 CSI_D0 differential pair.

CSI_DATA1-/CSI_DATA1+: CSI second input differential pair. It is managed by i.MX6 CSI_D1 differential pair.

CSI_CLK-/CSI_CLK+: CSI Clock input differential pair. It is managed by i.MX6 CSI_CLK0 differential pair.

MCLK: Master Clock, it is managed by i.MX6 GPIO_3 pin. It is suggested, however, to use camera modules with onboard crystal / oscillator, and avoid using this signal. Indeed, it could cause problems for EMI compliance requirements.

PWRON: external camera module Power enable signal. Managed by i.MX6 CSI0_DAT18 pin, it is a signal at electrical level +3.3V_S with a 100kΩ pull-up resistor.

RESET: external camera module reset signal output. Managed by i.MX6 CSI0_DAT19 pin, it is a signal at electrical level +3.3V_S with a 100kΩ pull-down resistor.

I2C3_SCL: general purpose I2C Bus clock line. Output signal, electrical level +3.3V_S with a 4k7Ω pull-up resistor. It is managed by i.MX6 processor's I2C3 controller. It is the same signal that is available also on

I2C3_SDA: general purpose I2C Bus data line. Bidirectional signal, electrical level +3.3V_S with a 4k7Ω pull-up resistor. It is managed by i.MX6 processor's I2C3 controller.

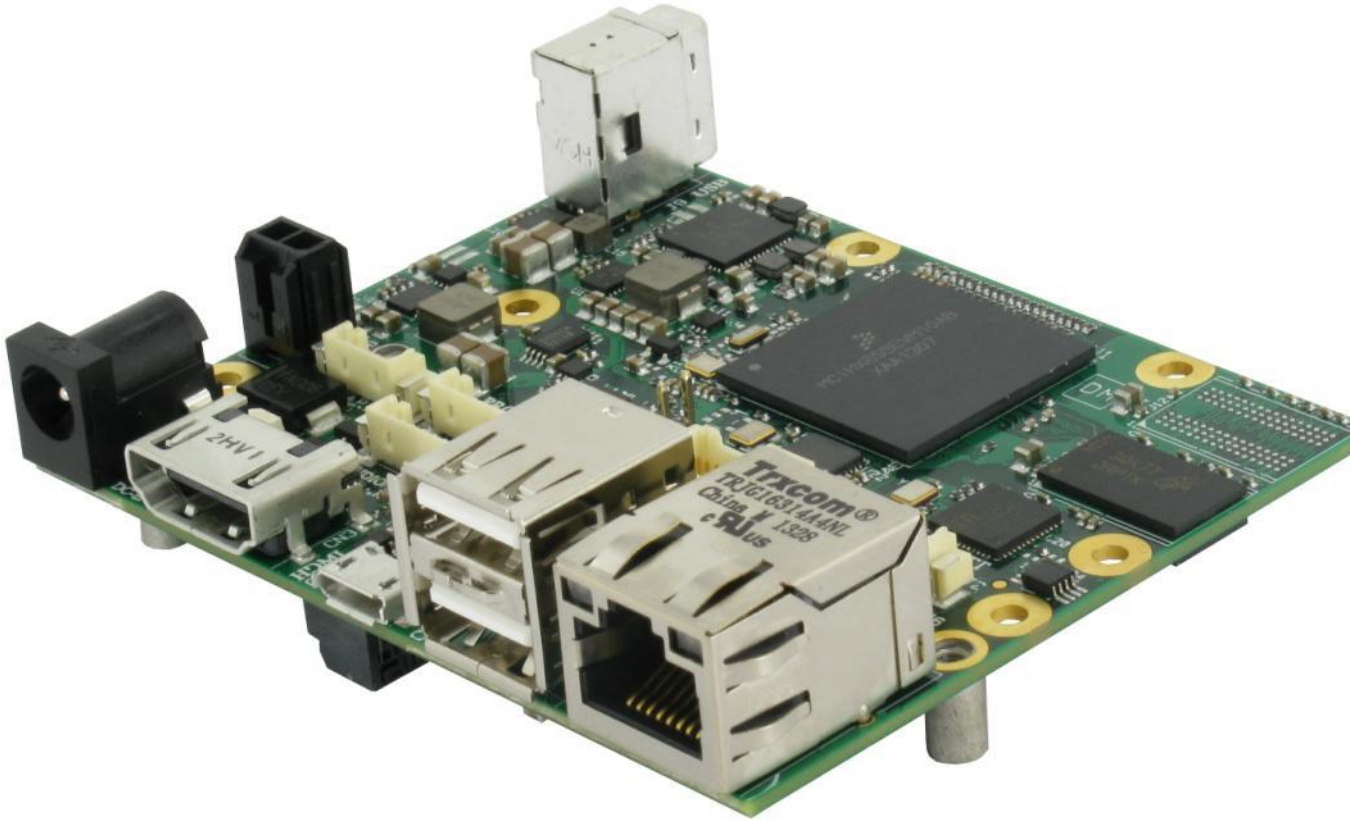
3.3.11 Recovery jumper

On board, there is a 2-way jumper that can be used to force i.MX6 processor in recovery mode.

For normal working of the board, this jumper must not be inserted. It has to be plugged only in case the system must be reprogrammed.

Chapter 4.
APPENDICES

- Thermal Design
- Accessories



4.1 Thermal Design

Highly integrated systems, like the SBC-984 board, offer the user excellent performance in a very reduced space, therefore allowing the system's minimization. On the other hand, the miniaturizing of IC's and the increase of clock frequencies of the processors lead to the generation of a big amount of heat that must be dissipated to prevent critical operating conditions, system hang-off or failures.

It is extremely important to note that, for this reason, a critical design parameter always to be kept in very high consideration is the thermal design and analysis of the final assembled system. It is necessary to carefully consider the heat generated by the module in the final assembled system and the application.

The customer must always ensure that the heatspreader/heatsink surface temperature remain within the declared operating temperature range at any point of the cooling element.

SECO can provide the customer with SBC-984 specific heatspreader and/or passive heatsink, which will act ONLY as a thermal coupling device. It is not intended to be a stand-alone cooling system, but a means of transferring heat to an external, passive or active cooling element, like heatsinks, fans, heat pipes, etc. The SECO heatspreader is thermally coupled to the most critical heat - generating board components and surfaces using a thermal gap pad, which optimizes the heat exchange between the module and the heatspreader.

During the development phase, in a laboratory, in free - air conditions or just for software development and system tuning, then a simple heatsink might be sufficient to cool the board and keep it within its declared operating temperature range (especially for the i.MX6 Solo and Dual Lite versions). However, please keep in mind that all these considerations depend on the workload of the processor. Heavy computational tasks will generate much more heat on all versions of the processor.

Therefore, it is always necessary that the customer study and develop a specifically tailored cooling solution for the final system by evaluating processor's workload, application environment, system enclosure, air flow and so on. Please remember that the use of SECO heat-dissipation components must be accurately evaluated within the final system and that they should be part of a more comprehensive ad-hoc cooling solution.

Ordering Code	Description
S984-DISS-1-C-PK	SBC-984 Heat Spreader (passive) for COMMERCIAL VERSION and Solo & DualLite INDUSTRIAL, packaged
S984-DISS-1-I-PK	SBC-984 Heat Spreader (passive) for Dual and Quad (AUTOMOTIVE & INDUSTRIAL), packaged
S984-DISS-2-C-PK	SBC-984 Heatsink (Passive) for COMMERCIAL VERSION and Solo & DualLite INDUSTRIAL, packaged
S984-DISS-2-I-PK	SBC-984 Heatsink (passive) for Dual and Quad (AUTOMOTIVE & INDUSTRIAL), packaged

4.2 Accessories

SECO can offer various accessories in completion of SBC-984 functionalities

4.2.1 RS-232 programming kit ASK-825REVB

This kit is necessary to connect Debug programming port, available on connector J7, to a standard PC serial port.

The kit is made of:

- TTL-to-RS232 serial port adapter
- Connection cable between SBC-984 board and TTL-to-RS-232 adapter

To use this kit, connect the cable to connector J7 on SBC-984 board and to connector CN3 on the TTL-to-RS232 adapter module. The debug serial port will now be available, at RS-232 level, on the module's connector CN1, which is a standard DB-9 male connector.

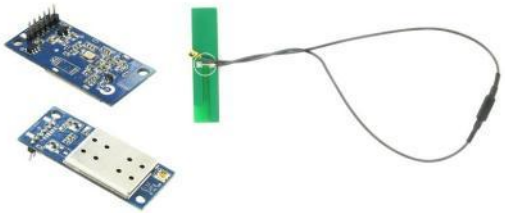
The connecting cable will also carry out the two I2C signals available on connector J7. On the adapter module, these signals cannot be used, this means that the user can disconnect the two wires from the 10-pin connector and use them to connect an I2C touch Screen controller. Yellow Wire: I2C3_SCL signal, White wire: I2C3_SDA signal.

4.2.2 WiFi Modules

As stated in paragraph 3.3.4, on the SBC-984 there is an internal USB port, on a 7-pin female header, which has been purposely designed for the connection of USB WiFi modules, although it can be used for any USB 2.0 compliant device.

SECO can offer two different WiFi modules on USB pin header. Both of them are IEEE 802.11 b/g/n compliant, FCC Part 15 and CE compliant, 150Mbps maximum data rate, security support for 64/128 bit WEP, WPA, WPA2, TKIP, AES.

The first module has an integrated PCB antenna, and is based on Ralink RT5370 chipset.



The second module, instead, is based on Ralink RT3070 Chipset, and it is supplied with an external 50Ω 2.4GHZ antenna.

> **!** Please be aware that the module with external antenna has a 6-pin USB interface, so, when mounting it on 7-pin connector CN4, it is necessary to insert it in pins 2-7, leaving pin 1 free.

Obviously, these are not the only WiFi modules that can work combined with the SBC-984 board. The customer can choose any USB WiFi module. However, please remember that SECO cannot support customers if they choose to use modules different from those provided by SECO, and whose drivers are already included in SECO's provided BSPs.

Please contact SECO for ordering p/n.

4.2.3 Cabled RTC battery.

As stated in paragraph 0, for the occurrences when the module is not powered with an external power supply, it is possible to connect a cabled coin 3V Lithium Battery to supply the Real Time Clock embedded inside i.MX6 Processor.

SECO can provide for an optional cabled RTC battery, which is a CR2032 coin cell battery, 3V 230mAh, with a 30mm long connecting cable.

Please contact SECO for ordering p/n.

4.2.4 CSI Dongle Camera VA09

This optional module offer the possibility of connecting a commercial camera module, which is KLT Auto-Focus 5MP Camera module JAL-2721, based on the image sensor OV5640 manufactured by Omnivision Technologies, Inc.

Such a commercial camera module is perfectly integrated in the module VA09, which also includes a 15cm, 16-poles FFC cable necessary to connect the module to SBC-984 (connector CN11).

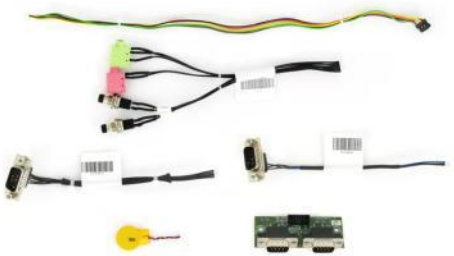
By using this combined camera module, it will be possible to capture images with a resolution up to 2592x1944 at a frame rate of 15fps (FullHD at 30fps), and many other advanced features.

More info about the camera CMOS Sensor can be found at http://www.ovt.com/products/sensor.php?id=93.

More info about the camera module is available at http://www.kailaptech.com/product.aspx?id=832&l1=512.

Please contact SECO for ordering p/n.

4.2.5 Accessories kit CABKIT984REVC



This accessories kit includes the following items

- RS-232 programming kit ASK-825REVB
- Cabled RTC battery
- DB-9 male adapter cable, for the connection of RS-232 compatible peripherals / PCs to board's connector J5
- CAN adapter cable with DB-9 male connector, for the connection of the board to a CAN Bus using dedicated connector J6.
- Power button, reset button, Line Out jack, Mic in Jack adapter cable, can be connected to board's connector J11.

4.2.6 7” Display Kit

This kit offers a 7” RGB display, 800 x480, 262K colors, with integrated capacitive Touchscreen.

The kit contains also the VA02 adapter module (already assembled on the display), and the cable necessary for the connection to SBC-984 board.

To use this kit, simply connect the cable to connectors J1, for the 18-bit single channel LVDS interface, and J7, for the I2C interface necessary for the integrated Touch controller.

The other side of the cable only needs to be plugged into adapter’s module’s connector CN1.

Please contact SECO for ordering p/n.

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